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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SOUW, BERNARD E	
ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 10/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Applicati n N .	Applicant(s)
	09/826,326	HAYES, CECIL E.
	Examin r	Art Unit
	Bernard E Souw	2881

-- The MAILING DATE of this communication appears on the cover she t with the correspond nc addr ss --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 April 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 and 3-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimo et al. (USPAT 6,297,636) or Nakabayashi (USPAT 5,028,872) in view of Richard (EP 0 724 164 A1).

Regarding claims 1, 8, 9 and 20, Shimo et al. disclose a radiofrequency (RF) magnetic shield for use in a RF system including an RF magnetic field resonators 6 & 6' having a magnetic component and an electric component, as recited in Col.4/ll.20-24 and shown in Fig.1, the RF magnetic shield (not shown in Fig.1) expressly recited in Col.3/ll.62-65 as being located between gradient coil 4 & 4' and transmitter coil 6 & 6', respectively.

In the alternative, Nakabayashi discloses a radiofrequency (RF) magnetic shield 23 shown in Fig.1A and 1C, as recited in Col. 4/ll.40-41 and Col.4/ll.63-68 and Col.5/ll.1-2, for use in a RF system including an RF magnetic field resonator 4 having a magnetic component and an electric component, as recited in Col.3/ll.65-67 & Col.4/ll.1-7.

However, neither Shimo et al. nor Nakabayashi describes the detailed structure of the RF magnetic shield. Richard et al. disclose a similar RF system very similar to

Shimo's and Nakabayashi's, including an RF magnetic shield. As recited in Sect.[57]/ll.11-20, Richard's RF magnetic shield 60 shown in Fig.3 comprises a dielectric layer having a plurality of conductive regions 72 separated by non-conductive regions 62 on each side of the dielectric layer, as recited in Sect.[57]/ll.13-14, the conductive regions 72 overlapping on opposite sides of the dielectric layer to form a plurality of capacitive elements, as recited in Sect.[57]/ll.7-10 and Col.3/ll.1-13, which are partially conductive at radiofrequencies, as recited by in Col.3/ll.13-18, such that the electrical component tangent to the shield is other than zero and the magnetic component perpendicular to the shield is essentially zero, which is a property inherent to that kind of RF magnetic shields conventionally used in MRI apparatus.

While both Shimo and Nakabayashi do not describe in detail, how the magnetic shield is constructed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make Shimo's endcap shields or Nakabayashi's RF magnetic shield 23 according to Richard's teaching of alternating dielectric and conductive layers to form capacitive elements that are partially non-conductive at radiofrequencies, since such construction proves to be superior to other conventional designs (e.g., copper strips or copper mesh) with regard to minimizing the eddy current generated by strong gradient fields in faster and higher resolution Magnetic Resonance Imaging (MRI) devices, the eddy currents being known to limit the gradient slew rates, as taught by Richard et al. in Col.1/ll.56-59 & Col.2/ll.1-4 and Col.2/ll.43-45.

► Specifically regarding claim 8, the limitation that the RF magnetic field coil comprises a birdcage coil is recited by Shimo et al. in Col.9/ll.29-31 and by Richard et

al. in Sect.[57]/ll.8-11, whereas the limitation that the RF magnetic shield comprises an endcap on an end of the birdcage coil, as recited by Shimo et al. in Col.3/ll.62-65 as being located between 4 & 6 and 4' & 6' in Fig.1, which form an endcap on an end of the birdcage coils 612 and 614 & 614' shown in Fig.14 and 15.

► Specifically regarding claim 9, the limitation that the RF magnetic shield is substantially planar and circular is recited by Shimo et al. in Col.11, claim 5, whereby the gradient coil 4 & 4' and transmitter coil 6 & 6' are both of circular form, as shown in Fig.1.

► Specifically regarding claim 10, the limitation that the birdcage resonator has a plurality of rungs that are connected to a plurality of conductive regions on the shield is recited by Shimo et al. in Col.9/ll.21-43, referring to a plurality of electric paths 612 connected to 614 and 614' shown in Fig.14 & 15.

► Regarding claims 3 and 21, the limitation that Nakabayashi's RF magnetic field coil 4 and the magnetic shield 23 form a sample volume is disclosed in Fig.1A & 1C.

► Regarding claims 4, 6, 22 and 24, the limitation that a capacitive voltage is developed across the capacitive elements at radiofrequencies is specifically recited by Richard in Sect.[57]/ll.20-24.

► Regarding claims 5 and 23, the limitation that the capacitive voltage developed across the capacitive elements at radiofrequencies is about one quarter of a total capacitive voltage developed at the resonant frequency is well known in the art, since the capacative voltage developed across a resonant circuit is maximum at the

resonance frequency, wherein the recited limitation of one quarter is an approximate value based on the Q-value of the resonance circuit, which is inherent to every resonant circuit, as described in all basic lectures on alternating current, such as, e.g., in Fig.10 of "Signals & circuits" brochure, in Fig.4 of "hipotronics" brochure, and in Fig.20.17, curve V_C of R.L. Boylestad lecture.

► Regarding claims 7 and 25, the limitation that the capacitive elements are substantially non-conductive at audio frequencies, is inherent in Richard's RF magnetic shield made in the form of an array of RF capacitors, since the impedance of such a capacitor is known to increase (i.e., the capacitance becomes increasingly non-conductive) at low frequencies, such as audiofrequencies.

► The limitation of claim 11 is rendered obvious by Shimo et al. in Col.5/ll.4-8 and 27-28, reciting symmetries of integer multiples of four.

► The limitation of claim 12 is disclosed by Shimo et al. in Fig.4-8, showing radial segments divided by radial spokes.

► The limitation of claim 13 is rendered obvious by Shimo et al. in Col.5/ll.32-35, referring to electric currents shown by arrows in Fig.5 and 7.

► Regarding claim 14, the limitation that the RF magnetic field coil comprises a cylindrical body is shown by numeral 61 in Shimo's Fig.13, as recited in Col.8/ll.64-67 & Col.9/ll.1-9, and the limitation that the RF magnetic shield comprises a cylinder disposed about the body coil is recited by Shimo et al. in Col.12/claim 14.

► Regarding claim 15, the limitation that the RF magnetic field coil comprises a conductive regions defining a pattern having 4-fold symmetry is shown by Nakabayashi in RF magnetic shield 21 comprising 4 components 21-1 to 21-4 shown in Fig.2A recited in Col.6/ll.33-43 and in Fig.3A, recited in Col.7/ll.3-12.

► Regarding claim 16, the limitation of a 6-fold symmetry is a mere matter of design choice comparable to the 4-fold symmetry recited in claim 15, which does not have critical impact on the proper functioning of the device, and furthermore, involves only routine skill in the art, hence, unpatentable.

► Regarding claim 17, Shimo's RF magnetic shield (not shown in Fig.1) comprises an annulus disposed about the surface coils 6 and 6' in Fig.1 and Fig.2, is recited in Col.3/ll.58-67, whereas the annulus form is specifically recited in Col.4/ll.53-67 & Col.5/ll.1-12 .

► Regarding claim 18, Shimo's RF magnetic field coils 606, 602 & 602' shown in Fig.2-7, and coils 614 & 614' shown in Fig.14 & 15, are substantially planar and annular, as recited in Col.5/ll.19-34 and Col.9/ll.10-53, wherein the annular form is specifically recited in Col.5/ll.19-21 and Col.9, lines 8, 21, 38 and 42.

► Regarding claim 19, Shimo's RF magnetic field coils 606, 602 & 602' shown in Fig.2-7, and coils 614 & 614' shown in Fig.14 & 15 include a hole 606 shown in Fig. 2, 3 and 7, which is sized and shaped to match the surface coil 612 shown in Fig.14-15.

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shimo et al. in view of Nakabayashi and Richard et al., as applied to claims 1 and 20 above, and further in view of Sakakura et al. (USPAT 5,396,173).

Shimo et al. as modified by Nakabayashi and Richard et al. show all the limitations of claim 2, as applied to the parent claim 1 above, except the recitation that the conductive re3gions of the magnetic shield of claim 1 define a pattern having approximately equal capacitive impedance per unit length in at least one direction.

Sakakura et al. disclose an RF magnetic shield 17 shown in Fig.6 & 10 for use with MRI, as recited in Col.7/ll.20-30, wherein each capacitor layer or element 17b have approximately equal capacitive impedance per unit length in at least one direction, as recited in Col.7/ll.31-40.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to make each capacitor layer or element 17b having approximately equal capacitive impedance per unit length in at least one direction, since this eliminates the need for excessive care to longitudinally positioning the capacitors, thus making easy their assembly, as taught by Sakakura et al. in Col.7/ll.40-47.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305 0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

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September 10, 2003